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Technology Forecasting – Who Needs It?

by Norman F. Simenson

Everyone. It is not a question of whether or not you do it but of whether or not you apply some scientific/engineering discipline. When video tape Beta and VHS formats were competing, every purchase of a VCR was a bet on which format would win out. (How many of you bet wrong and had to retape all the old movies you wanted to save?)

Until quite recently, the FAA did not pay too much attention to the consequences of betting wrong on a future technology. If we bet wrong, we could always pay the manufacturer (or someone) to maintain a steady supply of any technology that had become peculiar to the FAA. This approach has become prohibitively expensive (in some cases we are paying 100 times or more over comparable, readily available and frequently superior technology). And, increasingly, reliable companies are reluctant to divert the resources to support the continued manufacture of small lots of obsolete technology at any price.

We are living in a world where a project of modest schedule (e.g., 3 to 5 years) can see major portions of the technology it is based on go obsolete within the first few years! If the project cannot adapt to changing technology in a timely way, maintenance costs can become so high that the eventually fielded system is, for all practical purposes, unmaintainable.

First, we must do a much better job of separating function from technology.

What are the solutions? First, we must do a much better job of separating function from technology. Instead of specifying radars, we need to specify "surveillance systems." Writing true functional specs is a horribly difficult art which few people have mastered—but that is the direction we need to go, however crudely. Once the functions and technology are separated, it becomes a much simpler problem of substituting one technology for another. Indeed, once you get a good functional spec (as opposed to a "bigger, better, faster" technology oriented spec), alternative solutions may present themselves which involve completely other technology (or even non-technological) solutions which are much more cost beneficial.

One excellent example of how to write a functional as opposed to a traditional requirements specification was demonstrated by NASA. Instead of specifying a satellite transponder, including all of the technical knowledge that that entailed, they contracted and paid for "transponder days on orbit," with a penalty if it fell below a certain number of days per year, a premium if it exceeded the contracted for number of days per year, and a premium if the transponder continued useful operations past a certain number of years. This also eliminated maintenance and retirement headaches. So, it can be done — but it needs a lot of hard rethinking about what we really need and how best to phrase it.

The purpose of the technology forecast is NOT to forecast the future...

Second, we need to do technology assessment coupled with technology forecasting, and update that assessment/forecast no less often than every 6 months. This should be a critical ingredient of every Risk Management Plan prepared for all but the smallest projects. There is the real possibility that new technology or other factors may render some part or all of the purpose of the project obsolete; there is the possibility that the base technology committed to by the project is, or shortly will be, obsolete; there is the possibility that the technological environment/interfaces assumed by the project is, or shortly will be, obsolete, etc. We especially need to be aware (beware?) of interfaces, or we may one day be trying to run a 2010's system with 1960's interfaces, because it is so difficult to update interfaces. Since

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FULLY INTEGRATED AND NETWORKED ENTERPRISE MANAGEMENT

The following is NOT a theoretical dissertation. Fully integrated and networked enterprise (FINE) management describes REAL products which are emerging as an organization's most strategic asset. Some or all of this software is running in half of the world's 500 largest companies—doing production scheduling at General Electric Company and controlling distribution at Coca-Cola Company. It's probably a significant factor in both the unmeasured and measured increases in back office productivity. Microsoft and Intel are not just customers: they are actively promoting it through various collaborative efforts with the original development companies. Intel has formed Pandesic, an electronic-commerce joint venture, with German software giant SAP solely to promote FINE software products.

FINE works as follows:

Step One: A need is identified or an order taken.

Step Two: The ability to fulfill the need or order is assessed. Organizational plans are developed and activities set in motion to identify and secure the necessary resources to satisfy the need or fulfill the order, from throughout the enterprise. Planning is initiated to accommodate any immediate and/or local shortfalls.

Step Three: Plans are made to rectify both immediate and potential shortfalls, e.g., of personnel or product or inventories. Resources may be reallocated. Increases in resources or product are requested as needed.

Step Four: Human resources are assigned and any shortfalls in staffing or skill levels are identified. Personnel ensures that the needed human resources are maintained at sufficient levels to avoid the development of bottlenecks. Hiring and training are scheduled as needed. Estimates of the job market are undertaken to anticipate any developing shortages of critical skills throughout the enterprise area and at key points. Need for contingency planning is highlighted.

Step Five: Physical resources are assigned and any shortfalls in inventory, fitness, or quality levels are identified. Logistics ensures that the needed physical resources are maintained at sufficient levels to avoid the development of bottlenecks. Production and purchasing are scheduled as needed. Estimates of market sources are undertaken to anticipate any developing shortages of critical products or materiel throughout the enterprise area and at key points. Need for contingency planning is highlighted. New production tooling plans are developed as needed.

Step Six: The customer can log onto a selected subset of the system and learn the status of her order and make any changes necessary. The customer is also provided with a snapshot of what is currently available that is related to her current and past orders and/or may prove helpful. The customer can ask for still more information, but remains fully in control.

Step Seven: Upper management can review reports on what needs are being satsfied and what orders filled and make plans, based on trends and other data, to anticipate future needs and orders. ***This allows management a key role in forecasting for the future of the enterprise, based on almost current data, not on guesswork and old data.*** Moreover, the data show the real state of affairs—strictly local or short term variances are largely ignored.

All of the above is handled by dozens to hundreds of nearly independent software packages which nevertheless are cooperative, fully integrated, and networked. The individual packages may be running at a few locations in a fairly restricted area, or at hundreds of locations over a wide geographic area. ■

Software EXCHANGE

For all of you out there using WORD 6 who would like to read WORD 97 documents:

- Create a new subdirectory for WINWORD called "WIN97."
- Internet to www.microsoft.com and search for "word 97 converter."
- Down load "wrd97cnv.exe" into the WIN97 subdirectory and run it using the WINDOWS' "RUN" command. Then run the setup.exe file using the "RUN" command.

wrd97cnv.exe is FREEWARE.

If you would like an inexpensive improvement on WINDOWS 95 Explorer (not the Internet Explorer), check out "Windows Commander for Windows 95" at www.ghisler.com. This program is SHAREWARE.

If you would really like to supercharge WINDOWS 95 "Quick View" feature, try Quick View Plus which adds 190 filetypes to the viewer and such features as printing, copying to the Clipboard, etc. SHAREWARE at www.inso.com.

If you want to send binary files over the Internet, it's hard to beat "NETSEND." FREEWARE from jtucker@byron.apana.org.au. It does not require a decoder at the receiving end! ■

interFACE

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THE EUROCONTROL EXPERIMENTAL CENTRE (EEC)

by Jean-Marc Garot, Director. (Reprinted from SKYWAY, summer, 1997)

Jean-Marc Garot greatly assisted with the development of FAA's own Advanced Automation System (AAS) in the mid to latter 1980's. He served on the AAS Architecture group from its inception until its worked was concluded

Joining the Experimental Centre some two years ago, I had a mind to change the Centre. I suspected that some kind of audit/reorganization/ redeployment/reassessment of the EEC was expected. I knew that for any kind of evolution there is a six month window of opportunity: you either grasp it or lose it forever.

Normally, I would have started with a vision, objectives, a strategy, a business plan, a budget then a reorganization ... if necessary. **I decided to move the other way around because I thought *cultural change* was needed** [emphasis added by editor]. It has been said that "cultural change" has no meaning but we at the EEC believe that we have proved otherwise. And what was the driving force? TRUSTING PEOPLE, for they are worth it. There is more risk in not trusting our people than in trusting them.

A few examples:

- Push for the decision to be taken at the lowest possible level, [but ensure that] guidance and support is always available [from] higher level[s]. The prerequisite is, once again, ***trust***.
- Streamline [the] organization as [much] as possible to improve speed of [response and action] and agility.
- [Flatten the organization into a more] horizontal co-ordination, [emphasizing the] supplier/customer relationship more than [the] vertical "pass the buck up and down."

We suppressed one layer; we created centres of Expertise (CoEs), and people chose in which CoE they wanted to work.

Within the Centre, there were some who did not believe that it could work. Outside the Centre, there are those who still do not believe it. But it did work and was achieved in less than six months in the second half of 1995, largely thanks to the support of our people, the Staff Committee, and also the Union.

An organization is essentially a representation of its people at a given time. You cannot design an organization and then try to squeeze people into it. Moreover, people are changing all the time and hence the organization will also be in a continuous state of change.

Roles must be flexible to foster creativity and expand the scope of action. Mobility is the essence and is initiated horizontally and from the bottom-up as well as the traditional top-down. Training and retraining are paramount. The total effort invested in training in 1996 showed an increase of 41% compared with 1995; it doubled compared with 1994.

The EEC exists to carry out research and development. Management, administration and support are essential activities ***but are nevertheless ancillary***. As a direct result of reorganizations and of ***process improvements***, we have managed a significant transfer of resources from overheads to projects. [Project spending has gone from 43% of the total to 54%; support has gone from 26% to 23%; and facilities/housekeeping from 31% to 23%.]

Of course we do not pretend that the organization is perfect. The Centre of Expertise concept and lateral coordination are working well but must still be improved. The matrix orientation is not yet fully functional. We do not yet have complete visibility on the allocation of people to projects. There are weaknesses in the project orientation of the budget. Nevertheless, the problems are being systematically identified and addressed as part of the ***continuous improvement process***.

If we look at the 1996 EEC Annual Report, we see that all indicators show a steady improvement in EEC performance when compared with previous years.

The main role of the EEC should be to integrate components coming from other partners. This is how I see the total life cycle process:

- Enabling technology or research: sharing among partners, while the EEC keeps a few niches;
- Integration at the EEC;
- Validation (simulation/on site experimentation) with partners from Member States;
- 'Industrial' development, maintenance, support to users: to be transferred to industry in a way which has still to be developed.

The 1995 reorganization was never seen as an end in itself but rather as the beginning of a ***process of continuous change***. That is the reason why the second reorganization at the end of 1996 following the project reviews was as important as the first one.

The new culture that we have forged together at the EEC is a solid foundation from which we can reach out with modesty but with confidence to the new tasks which lie before us. ■

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PLANNING A USER "EXTRA FRIENDLY" SYSTEM

"User friendly" systems not only have basically intelligible user interfaces, but generally allow the user wide latitude in redesigning them (like WINDOWS). All user friendly systems include a capability which allows the user to design his/her own shortcuts. But this immediately raises a problem. No matter how simple a macro language, it requires the user to think like a programmer and acquire a skill that is irrelevant to his/her normal work. This is not natural: most people think like people, not programmers. And no matter how versatile the macro language, it is severely restricted by the basic architecture of the underlying software (no macro set can convert a spreadsheet program into anything but the crudest word processing program).

This is one area in which artificial intelligence seems to be working. New software now comes with "coaches" and "wizards" that tell you how to do what you are doing (or what you want to do) in a shorter/easier way. Other new software writes macros for you (at a somewhat more elaborate level than simply capturing keystrokes). And context sensitive, on-line help has gone from a nicety to a standard feature.

In the November 1993 issue of IEEE Computer, Jakob Nielsen of Bellcore notes the benefits of "Iterative User-Interface Design." You won't get the perfect interface on your first try, so why not plan to improve it over time? Nielsen notes that this rather obvious idea has been tried for years, then goes on to address the problems faced in implementing the concept, from selecting the test users (neophytes or experts?) to measuring the results (was the latest change really an improvement?). It's a good article.

If this sounds something like up-front prototyping, it's not. It's really something rather more sophisticated. It means giving your customer a system in which the look and feel is easily changed by the operator with no knowledge of and little interest in programming. It means also providing the capability for the more determined, more skillful operator to develop significant shortcuts for his/her work.

Menus are nice for the novice operator but incredibly tedious for the expert operator. Even frequently seen warnings are quickly ignored by flying fingers and are thus worse than useless. (It promoted an industry of unerase programs!) A powerful macro language (with lots of on-line help) or a macro generator designed for the non-programmer provides the ability for the expert user who is so inclined to design shortcuts to improve productivity in a major way. (But it requires a very flexible architecture to support it.) It is also a very convenient way for a maintenance programmer to tailor the system to the needs of the moment without compromising the basic structure of the program or in any way limiting its future possibilities.

At a still deeper level, it means an object oriented program with easily replaced objects or an architecture based on set of very general kernel capabilities to support the features desired by the user and in which the feature components are easily added, replaced, or removed when obsolete. A really good kernel MIGHT support the features for a spreadsheet program OR a word processing program (although perhaps not quite as well as a specially designed program). That kind of flexibility sharply reduces future programming needs and delays program obsolescence.

One thing is certain: probably 50% of what we will be doing tomorrow we are not doing today. Better plan for it. While you are at it, remember that the hardware will be different and certainly faster and more capable by orders of magnitude. The leading edge systems of today will be obsolete before sundown tomorrow and users will be crying over having to make do with systems they would die to have today. ■

'PLUG AND PLAY' INTELLIGENTLY RECONFIGURABLE SYSTEMS OF THE FUTURE

WINDOWS 95 features 'plug and play' capability for add-on hardware and software components. What this means is that any new WIN95 compatible add-on hardware (video driver, disks, modems) is supposed to have sufficient intelligence on-board to negotiate an interface with WINDOWS 95 and with other computer components (with the assistance of WINDOWS 95), and to adjust its own parameters to optimize its performance with the particular computer configuration into which it is plugged. Users will increasingly be freed from having to adjust dozens of parameters using arcane setup programs and even more arcane installation manuals. This is the systems approach for the next millenium.

Increasingly, systems components (software + hardware) will be designed with sufficient intelligence on-board to negotiate interfaces and cooperative behavior within a common systems environment. To some extent, this can even be seen happening with purely software components on such heterogeneous systems as Internet. Everybody had better begin to design subsystems accordingly. (Cooperative interaction with the rest of a system is desirable, but not necessary. It is amazing how adaptive we can design a subsystem to be with relatively little effort but a lot of imagination.) We cannot rely on a human "expert" being available to solve the problems when a new interfacing subsystem arrives years after a subsystem is fielded. In effect the adaptive subsystem can be thought of partly as an "expert system" embodying all of the smarts of the original implementation team. Systems composed of effectively implemented adaptive subsystems are highly evolvable and tolerant of future changes.

Properly implemented, this approach minimizes the impact of technology change. It is the best guarantee we have that the technological revolution we are experiencing will not leave chaos in its wake. ■

"Technology Forecasts – Who Needs It?"
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much of the technology we are talking about is not that unique to one Integrated Product Team (IPT), it may be desirable to have a single, hard core technology forecasting team for all of ARA.

The purpose of the technology forecast is NOT to forecast the future, but to provide the probabilities associated with various relevant technological trends, and to detect patterns in the evolution of past technology which are highly likely to occur in the technology of interest in the near future. For example, we can predict with a very high probability (and many corporations are betting a lot of money on it), that chip feature densities will increase ten fold over the next ten years or so. This is based on the history of advances in chip feature densities over the last 20 years and an assessment of the necessary science and technological capabilities already available in the laboratory. We can also predict that with chip features that small, chips will need to be designed to compensate for quantum "noise and cosmic radiation."

Third, we need to do a better job of architecting/designing subsystems and the National Airspace System (NAS) so that new technology and new subsystems can be easily introduced without disruption. From a programmatic viewpoint, this means shifting to the evolutionary/Pre-Programmed Product Improvement (P3I) cycle, or some variation. Projects need to commit to spending much more on a very robust front end architecture which can tolerate probable and forseeable changes over the full expected life of the subsystem. (This is not impossible or necessarily extremely expensive: because of the robustness of its architecture, UNIX is still around after 30 years and having been pronounced dead many times — it is still capable of giving WINDOWS NT a run for the money.) ■

Letter from the EDITOR

Not so long ago in an Agency not to be named, it was decided that a high speed modem capable of 9600bps was needed (the current common speed for modems was then around 300 to 600bps). A contract was let to the best qualified lowest bidder, and the development proceeded. Not too many years later, after two major and many minor schedule slips, and after the cost had ballooned about 300%, the product was delivered. With significantly less capability than originally contracted for, but still capable of 9600 bps. Only trouble was, it was then possible to buy a 9600bps modem for unconditioned telephone lines for about 10% of the price per unit of the contracted for modem. Needless to say, the speed has since gone up by a factor of four or five and the cost has gone down another 75%. MORAL: Never try to outrun an avalanche.

The development cycle of most new technologies is the familiar S shaped logistic curve—the start is slow, then rapidly develops into a burst phase, and then slows down as the technology ages. But even this is deceptive. Key technologies tend to experience breakthroughs just as they begin to "top out." (In the case of modems, the key breakthrough was the shift from substantially analog devices to all digital devices.) In larger modalities, e.g., transportation, the shift is from one type of motive technology to another—from natural power (human, animal, wind, waterfalls) to steam to internal/external combustion engines.

In any event, the only points at which the Government can intervene to promote a rapidly changing technology is at the knees of the curve. At the lower knee, strategic investment can greatly accelerate the transition through the knee to the burst phase. At the upper knee, the need is to spend money to stimulate a technological breakthrough—unfortunately, the tendency is to do more of the same, only with more money—so the Government is usually left behind when the next breakthrough does occur. The most cost effective way to promote growth at this upper point—in effect, to spur creativity—is to produce a set of reasonably broad criteria for a success, and then to offer a prize for the winner. The British, in particular, have had a long history of successes using this approach. Little else works in any consistent way. While the timing is unpredictable, it is never possible to reduce creativity to a timetable. If the effort seems to be lagging, double the prize money.

The object is to assess where we are in a technology cycle and how best to invest to maximize our return on investment—ROI. In particular, while promising technologies need "seed" money early on, the Government should never try to invest to improve the technology once past the lower knee of the curve and especially during a burst phase. At best, that will result in a complete waste of the invested money. At worst, it can cause the Government to embrace a technological direction which is other than mainstream and which can be very costly to recover from.

The best approach to spur growth during the lower knee phase is to promise some degree of market stability by guaranteeing a minimum demand, and to "invest" small amounts of money in very basic research, such as through university research grants, scattered among as many promising avenues as possible.

There is a second moral to the modem story: Go with the flow. In the end, the story of the modem proves you can't hurry an already fast moving technology. The best that you can do is plan to take advantage of how it is moving, through such techniques as pre-planned product improvement. In the next ten years, we can expect to see computer technology increase by another ten-fold in speed and memory density. The Government can do very little to positively influence the outcome or timing, except to provide a hospitable climate for innovation. But it can plan its systems so that new computers can be regularly injected every few years to increase capabilities many fold. We must never again so lock ourselves into a technology that we remain trapped into using it 30 years later. That is where we need to invest our money: in good forecasts of future technology trends and in devising ways to make our systems technology independent.

Norm

WHAT IS TECHNOLOGICAL FORECASTING?

As used here, technology refers to the application of empirical or scientific principles to the construction of any artifact. Thus, human technology predates civilization, as demonstrated by the tools used at least from Paleolithic time. Most important, science alone cannot be used to determine the future of technology. Simple human experience is at least as great a determinant of future technology as any science. Human needs and wants are the principal drivers of technology, although progress can be made in many ways.

It can occur by a novel application of old scientific principles, or by the application of newly discovered scientific principles, or simply by extending what we have done in the past—making it "bigger, better, faster." Medieval cathedrals were all built without benefit of science or science based engineering. It was all "trial and error"—though models were extensively used. However, since the laws of mechanics were unknown, the models were not necessarily all that helpful (if simple scaling were all that was required, elephants would have the relative dimensions of mice—only bigger). The usual practice was to build as grandly as one dared—until something buckled or collapsed—then back off a little. (Naturally, if you died in a cathedral collapse during prayer, you went straight to heaven, so there were few complaints.)

If we accept the common definition of "forecast,"—to estimate or calculate in advance—then we can define technological forecasting as the science (or art?) of predicting future characteristics or functions of useful artifacts, processes, procedures, or techniques.

A technological forecast deals with characteristics or functions, such as levels of performance or the capability to transmit three dimensional visual images. It does not state how these characteristics will be achieved or what form the implementation of the function will take. The forecaster's obligation is fulfilled by noting what current levels of performance will be exceeded and by what margin (within a confidence interval), or by identifying new or modified functions without indicating how these are to be realized.

Further, a technological forecast deals with *useful* artifacts, processes, procedures, or techniques. This is intended to exclude from the domain of a technological forecast those things intended primarily for display or amusement (e.g., art or games), where the predominant psychological motivational forces are affective as opposed to cognitive—things which make people feel good as opposed to things people need in order to function better at work or in their private lives.

The term "technology" can be used to focus on ever more specialized areas. We might speak of an aircraft propulsion system technology, or jet engine technology, or just turbojet engine technology. It is usual in technological forecasting to focus on a fairly narrow use of the term in order to increase the precision of the result.

A good technological forecast addresses at least four areas: the technology being forecast, the time frame of the forecast, a statement of the characteristics or functions being forecast, and a probability distribution associated with the forecasted event. (If there is a definite probability that the event will never be realized, then the distribution would have a right tail running to infinity.) Generally, increased precision in one area implies less precision in the other areas of the technological forecast

A good technological forecast will be useful, i.e., it will enable its consumer to maximize gains and minimize losses in the course of doing business. Note that this is not limited to commercial business, but encompasses all human activity for the purpose of satisfying needs (as opposed to desires). In almost every case, this is accomplished by narrowing the range of options for decision making and/or assigning probabilities to the remaining options from least likely (within some time frame) to most likely.

Everyone expects that a "good" forecast will come true, at least in part. After all, what good is a forecast that is wrong? If I plan a picnic, based on a weather forecast of "sunny skies all day," and it rains, I have a right to be aggravated. Most people expect the same for technology, economic, and political forecasts. But the analogy is fallacious. In these latter examples, the outcome is not independent of the forecast! The forecast itself can be expected to play a part in what happens. Indeed, the best use of a forecast of a serious technological disaster is to take measures to see that it does not happen. Perhaps the Soviets should have done some forecasting before attempting the experiments which led to Chernobyl.

The purpose of forecasts is to influence a decision maker. If the decision maker then acts on the basis of the forecast, it very well may be that she can influence the outcome sufficiently to the advantage of her sponsor that an objective observer will conclude that the forecast failed. But this is obviously hardly the case, since on the basis of the forecast the decision maker was able to improve the position of her sponsor relative to that if the forecast had not been made or acted upon. Consequently, we cannot evaluate forecasts simply on the basis of whether or not they "come true," but must put great emphasis on whether the forecast influenced a desision maker to make a "better" decision than otherwise.

There are many types of technological forecasting, but the only one which can help a program manager keep from fielding an obsolete, or nearly obsolete, system is the short term forecast (which used to be from five to ten years, but is now down to two to five years). Such a forecast is based on technology which has already proved feasible all the way through a pilot (or limited) introduction. The role of the forecaster is to decide on the relative technical, economic, sociological, and psychological consequences of various competing technologies in order to predict relative success or failure.

This still takes very broad vision—not many people predicted that the gasoline engine vehicle would surpass the railroads as a people mover and seriously compete as a freight hauler. Even fewer would have predicted the earlier triumph of railroads over canals and freight wagons. In most cases, the forecaster is blindsided not by a "breakthrough" in his own field, but by something happening in an allied or completely other field

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of which he is totally unaware or which he discounts as irrelevant. The best forecasts provide estimates for low probability events which can have large impact. And the biggest influence on the fruition of a technology is usually not even technical—the success of the railroads depended heavily on the ability of the railroad companies to borrow money from European banks. Later, the success of the automobile depended heavily on the ability of corporations to raise money in the stock market.

What can a good technological forecast do for us now? Let's consider the future of surveillance. We can safely assert that GPS will not replace primary radar in the foreseeable future (five years). GPS as employed in WAAS/ LAAS is a cooperative system; primary radar may still be necessary for uncooperative flying objects (UFOs). But recall, a good technological forecast is primarily aimed at evaluating the viability of competing technologies in the market-place. Since GPS has become so ubiquitous that boy scouts are abandoning hand held compasses for hand held GPS receivers, we can predict certain things. We can predict that GPS "transponders" will be built into new aircraft so that these will have to be actively ***disabled*** in order ***not*** to operate.

At that point, primary ATC radar would prove necessary only at critical points in the system, such as at airports (eventually, only for backup) and borders. This indicates that the current generation of long range radars is likely to last a long time and that any changes from here will be minor. We make no similar predictions for the short term or for weather radars except that no major breakthroughs/upgrades (like NEXRAD) are to be expected within the next five years. Even the military situation needs to be evaluated: the current military approach is to focus on passive as opposed to active detection systems. This puts military units using active detection at a disadvantage.

It is now possible, for example, to refocus the energy received from a sonar ping back to the exact location of the emitter. As radar beam riding missiles become ever cheaper, military active radar sites will become increasingly vulnerable. There are solutions, but none are likely to prove useful in the civilian market. In the end, long range radar for civilian purposes may be relegated to look-down radars from satellites. This is largely a maintenance and cost issue.

The foregoing is not to be taken very seriously as an expert forecast, since the writer is no expert in surveillance and has had no opportunity to research the literature or survey the field. It is intended only to convey the kind of **strategic** information a technological forecast can make in order to influence the flow of resources for the development of new technology and research. ■

Book Review - The Dilbert Future

by Scott Adams ©1997 by United feature Syndicate, Inc. ISBN 0-88730-866-X

Reviewing a book on DILBERT is a great way of getting in some really neat quotes without having to pay for it. In any event, Scott Adams (no relation to the Adam's family) has surveyed the future and predicts......more of the same.

More to the point, there is an entire section on Technology Predictions which readers should commit to memory. For example, DILBERT prediction 7, fully described in chapter seven is "Life in the future will not be like Star Trek."

In one of the cartoon sequences for this chapter, the pointy haired boss explains to DILBERT: "From now on, your salaries will be based on your predicted success, not your past performance. We ran a computer model against your education and DNA information. We predict you'll die in a stapler mishap within a week."

DILBERT asks: "What if I disagree with this prediction?"

The pointy haired boss answers: "Write up your opinion and staple it to the analysis."

DILBERT is too, too painfully true. For example, on the subject of the Star Trek transporter, Scott Adams comments: "It would be great to be able to beam your molecules across space and then reassemble them. The only problem is that you have to trust your coworker to operate the transporter. These are the same people who won't add paper to the photocopier or make a new pot of coffee after taking the last drop. I don't think they'll be double-checking the transporter coordinates. They'll be accidentally beaming people into walls, pets, and furniture. People will spend all their time apologizing for having inanimate objects protruding from parts of their bodies."

Scott Adams continues, "Managers will try to stop employees from any unsanctioned enjoyment at work. They know that enjoyment can lead to high morale and any number of other harmful things. Companies have a number of technologies for preventing enjoyment. For example, bosses can check logs of phone calls, block access to fun Internet sites, and even snoop on your e-mail. This enjoyment blocking technology is improving every day.

"Companies will give employees ID badges that can be tracked anywhere in the building, so managers can tell how much time you spend reading the newspaper in the restroom, wandering the halls, and hanging out in the cafeteria.

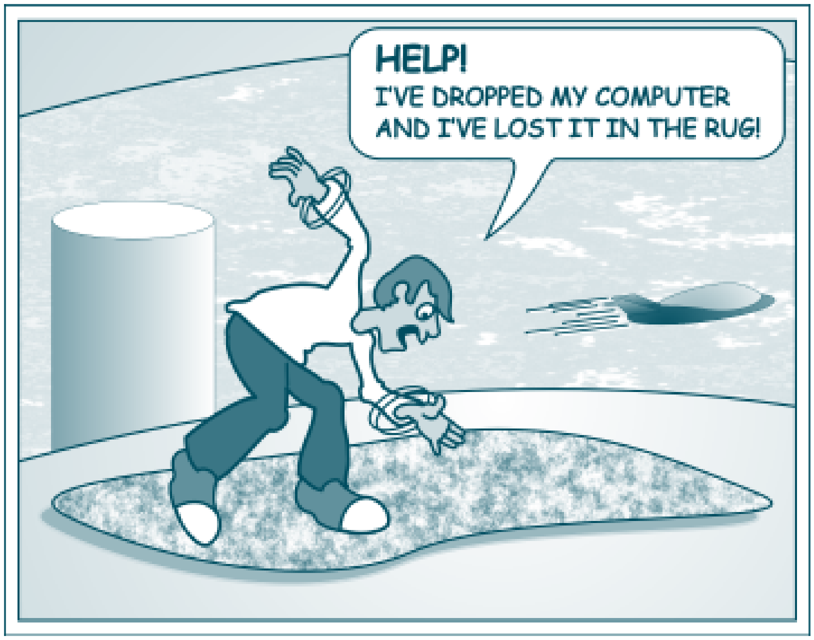
"...within a month of introduction, an underground market in counterfeit ID badges will spring up. Employees will lock their locator badges in desk drawers and roam freely wearing the fakes. ...

"...you'll see the emergence of a new industry dedicated to helping employees avoid work.."

In other words, as employers devise new and more sophisticated ways to monitor work activities, employees will put all of their creative and productive energies into discovering new ways to avoid work, leaving little left over for actually doing productive work.. There is a moral here.

I remain firmly convinced that a comprehensive reading of DILBERT (at least for the last three or four years) is the best management course we can provide for any actual or potential manager. Workers have taken to pasting DILBERT strips on their managers' doors—like Martin Luther pinning his 95 theses to the church door. Beware the Reformation! ■

In This Issue



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